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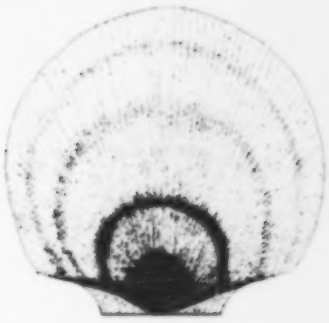
Maritimes Region
Canadian Science Advisory Secretariat
Science Advisory Report 2006/028

ASSESSMENT OF SCALLOPS (*PLACOPECTEN MAGELLANICUS*) IN SCALLOP FISHING AREA (SFA) 29 WEST OF LONGITUDE 65°30'W



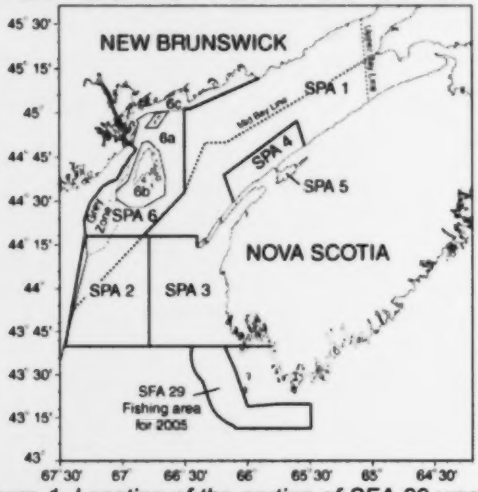


Figure 1. Location of the portion of SFA 29 west of longitude 65°30'W. Refer to full detail map in Figure 8 (last page) for place names.

Context

Scallop Fishing Area (SFA) 29 encompasses a very large inshore area inside the 12-mile territorial sea, from the south of Yarmouth (latitude 43°40'N) to Cape North in Cape Breton. This report refers to only that portion of SFA 29 west of longitude 65°30'W continuing north to SPA 3 at latitude 43°40'N.

Prior to 1986, the Full Bay Scallop Fleet fished in this area. Following the 1986 inshore/offshore scallop fishing agreement, fishing by the Full Bay Fleet was restricted to north of latitude 43°40'N. A limited fishery by the Full Bay Fleet was granted from 1996–98. Access was again granted to this fleet in 2001 with a full at-sea monitoring program and with a condition of a post-season industry-funded survey. SFA 29 is within Lobster Fishing Area 34 and, as a result, scallop fishers consulted with lobster fishers in the area to deal with potential conflicts. Lobster by-catch was minimal in 2001 despite high scallop catch rates. Lobster bycatch continues to be monitored in this fishery.

In 2002, the Minister of Fisheries and Oceans approved access to this area by the Full Bay Fleet and inshore east of Baccaro licence holders who are eligible to fish in SFA 29 west of longitude 65°30'W. SFA 29 inshore scallop licenses were historically restricted to east of Baccaro (east of longitude 65°30'W). A joint project agreement was signed with the fishing fleets, Natural Resources Canada, and Fisheries and Oceans Canada with all parties providing funds to conduct multi-beam acoustic mapping of the seafloor and other scientific work. A map showing bottom features for the entire area has been prepared and was distributed to the fishermen for the 2004 fishery. Work continues on analyzing surficial geology and the spatial distribution of scallops.

Advice on TACs for this area has been provided annually and is based on tracking the response of survey estimates of abundance to catches in the previous year. There is no framework or reference points for the fishery in SFA 29 at this time.

SUMMARY

- For the fifth consecutive year, a fishery was conducted in the portion of Scallop Fishing Area 29 west of longitude 65°30'W. Starting in 2002, the TAC was shared between the Full Bay Fleet and a limited number of inshore east of Baccaro licence holders who are eligible to fish in SFA 29 west of longitude 65°30'W (i.e., East of Baccaro Fleet).

- A total of 253 t (189 t Full Bay; 64 t East of Baccaro) was landed against a TAC of 255 t.

- Average meat weights from the fishery ranged from 14.9 g to 27.7 g and were not appreciably different from those observed in 2004.

- Average catch rate for the Full Bay Fleet was 41.8 kg/h over the whole area in 2005 compared to 54.4 kg/h in 2004. The average catch rate for the East of Baccaro Fleet was 27.1 kg/h over the whole area in 2005 compared to 32.0 kg/h in 2004.

- The annual survey indicates that biomass levels of commercial size scallop have remained fairly constant in subareas A and C with little recruitment to commercial size expected for the next three years. Biomass has increased in subareas B and D in 2005 with recruitment to the commercial size class expected in Subarea D for 2006.

- While a catch of 80 t in 2004 and 4 t in 2005 did not seem to result in a large decline in survey biomass, continued fishing in Subarea A in 2006 will probably be limited to scallops ages 6 and older due to limited recruitment.

- Evaluations of the impact of fishing were conducted using a population model for subareas B, C, and D. For example, catches of 75 to 100 t, 25 to 50 t, and 50 to 75 t would result in less than a 50% chance of a decrease in the 2006 biomass relative to 2005 for subareas B, C, and D, respectively. Alternatively, setting catch levels such that the mean expected decrease was equal to zero would result in 150–200 t for Subarea B, 75–100 t for Subarea C, and 125–150 t for Subarea D.

- There was not enough survey information to recommend catch levels for Subarea E. This subarea appears to offer marginal habitat for scallop.

- Bycatch of lobster in SFA 29 was low in 2005.

BACKGROUND

Description of Issues

A meeting of the Regional Advisory Process was held 27 March 2006 at the Bedford Institute of Oceanography, in Dartmouth N.S. to review the 2005 fishery and assess the status of the scallop stock in Scallop Fishing Area 29 in support of the management of the 2006 fishery. Participants included DFO scientists and fishery managers, representatives of the industry and provincial governments. Specifically, the meeting was called to provide TAC advice for SFA 29 scallop fisheries by subarea using analyses of catch rate and survey biomass trends. In addition, because this fishery occurs within Lobster Fishing Area 34, an assessment of the potential for lobster by-catch in each subarea was also provided.

Species Biology

The sea scallop (*Placopecten magellanicus*) occurs only in the northwest Atlantic Ocean from Virginia north to Labrador. Within this area, scallops are concentrated in persistent, geographically discrete aggregates or "beds", many of which support valuable commercial fisheries. Scallops in different beds, and in different areas of large beds, show different growth rates and meat yields.

Unlike many commercial scallop species, the sea scallop has separate sexes. Male scallops develop a white gonad in the summer months, while female gonads are bright red. Eggs and sperm are released into the water and fertilization takes place in the sea. Spawning begins in late August to early September, and the larvae drift in the water for almost a month before settling to the bottom in October.

The Fishery

The 2005 fishery opened 20 June and continued until 27 July with the exceptions of subareas B, C, and D which were closed on 22 July, 9 July, and 21 June, respectively, after having exceeded their respective quotas (Table 1). During 2005, a total of 253 t (189 t Full Bay; 64 t East of Baccaro) was landed against a TAC of 255 t. Prior to 2004, Subarea D had been closed to fishing because of the large number of young scallops in the subarea. The western half of Subarea D (west of longitude 65°40'W) was opened for the 2004 season after it was determined from the 2003 survey that there were enough commercial size scallops for a fishery. All of Subarea D was open for the 2005 fishery.

Average meat weights from the fishery ranged from 14.9 g to 27.7 g and were not appreciably different from those observed in 2004. Percentages of small meats (less than 8 g) continued to be extremely low.

Table 1. Scallop landings (meats, t) for SFA 29.

		Fleet					
		Full Bay		East of Baccaro		Total	
Year	Subarea	TAC	Landings	TAC	Landings	TAC	Landings
2001	Total	400	400			400	400
2002	29A	75	1	25	4	100	5
	29B	150	193	50	75	200	268
	29C	375	334	125	106	500	440
	Total	600	528	200	185	800	723
2003	29A						
	29B	150	114	51	38	201	152
	29C	188	33	63	32	251	65
	29E		2		2		4
	Total	338	149	114	72	451	221
2004	29A	150[1]	70	50[1]	10	200	80
	29B		33		47		80
	29E		<1		3		3
	29C	187.5	124	62.5	35	250	159
	29D	112.5	149	37.5	40	150	189
	Total	450	376	150	135	600	511
2005[2]	29A	45	2	15	2	60	4
	29B	30	23	10	26	40	49
	29C	75	92	25	23	100	115
	29D	41.25	63	13.75	11	55	74
	29E		9		2		11
	Total	191.25	189	63.75	64	255	253

[1] **TAC for 29A, B and E combined.**
[2] **Preliminary landings.**

ASSESSMENT

Average **catch rate** for the Full Bay Fleet was 41.8 kg/h over the whole area in 2005 compared to 54.4 kg/h in 2004. The average catch rate for the East of Baccaro Fleet was 27.1 kg/h over the whole area in 2005 compared to 32.0 kg/h in 2004. The highest catch rates in 2005 were in Subarea D with the Full Bay Fleet at 83.3 kg/h and the East of Baccaro Fleet at 48.1 kg/h. This was the first year that a fishery was permitted in the eastern portion of D and high catch rates were expected.

A post-season joint industry/departmental **research survey** has been conducted each year since 2001. During this time, there have been three vessels involved: F/V Julie Ann Joan (2001-2003, 2005), F/V Branntelle (2004), and F/V Overton Bay (2005). No comparative towing was conducted between F/V Julie Ann Joan and F/V Branntelle, but 10 comparative tows were completed between F/V Julie Ann Joan and F/V Overton Bay. Full analysis of the comparative data is still pending and, for this report, we will assume no differences among the three vessels.

In 2001, the survey was based upon a simple random sampling design over the whole area. From 2002 to 2004, subareas A-E were defined to be strata, with random sampling within strata. Subarea E has not been consistently covered in the survey due to time limitations; this subarea is considered to be marginal habitat for scallops and, as a result, has been less of a survey priority. In 2005, stratification was based upon the bottom types identified from the multi-beam mapping and geological groundtruth analysis in SFA 29. F/V Julie Ann Joan fished stations in subareas A-D, while F/V Overton Bay only fished stations in subareas C and D.

The highest concentrations of **commercial size** animals (100+ mm shell height) and **recruits** (90–99 mm shell height) occurred in subareas C and D (primarily on thin sand) with localized high concentrations in the sand wedge area of Subarea B (Figures 2 and 3). Based on ageing information, the recruit size range represents age 5 scallops that will recruit to the fishery in 2006.

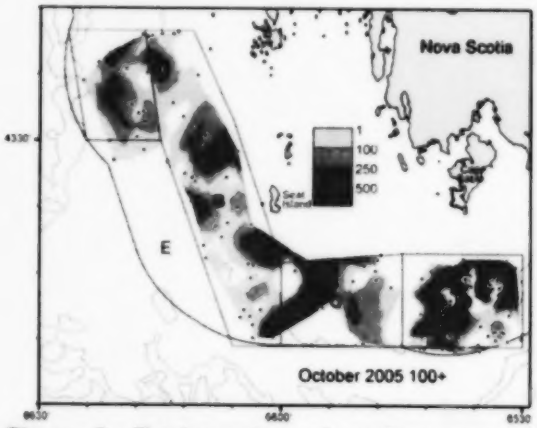


Figure 2. Total number of scallops per tow (commercial size: 100+ mm shell height).

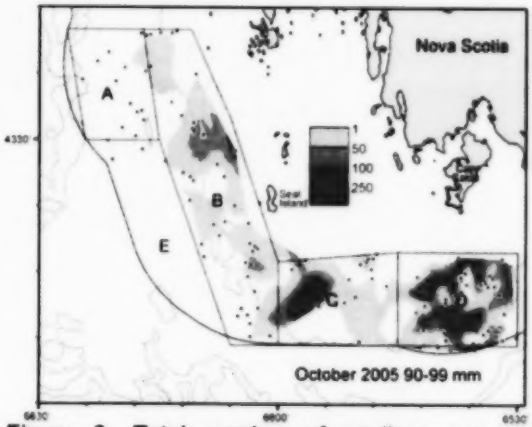


Figure 3. Total number of scallops per tow (recruits: 90-99 mm shell height).

The distribution of smaller size classes (65–89 mm shell height, expected to recruit to the fishery in two to three years) was considerably reduced with high densities only in Subarea D.

Densities of clappers (paired empty shells) were generally low with a local area of high abundance in the northern part of Subarea D. Spatial patterns in abundance of clappers tended to follow those for abundance of live scallops.

The change in stratification in 2005 does not appear to have changed the interpretation of the overall trend in biomass of commercial size scallops (Figure 4). Both stratification schemes indicate a dramatic increase in 2005, mainly due to large increases in subareas B and D (Figure 5). Increases in 2005 were mainly on thin sand and bedrock, bottom types typical of subareas B and D.

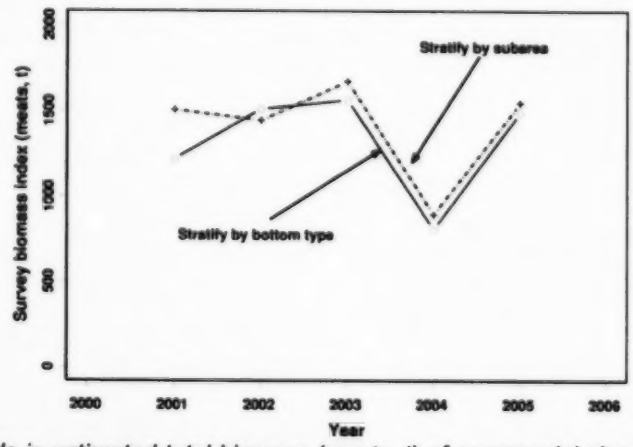


Figure 4. Annual trends in estimated total biomass (meats, t) of commercial size (100+ mm shell height) scallops in SFA 29 stratified by subarea or bottom type.

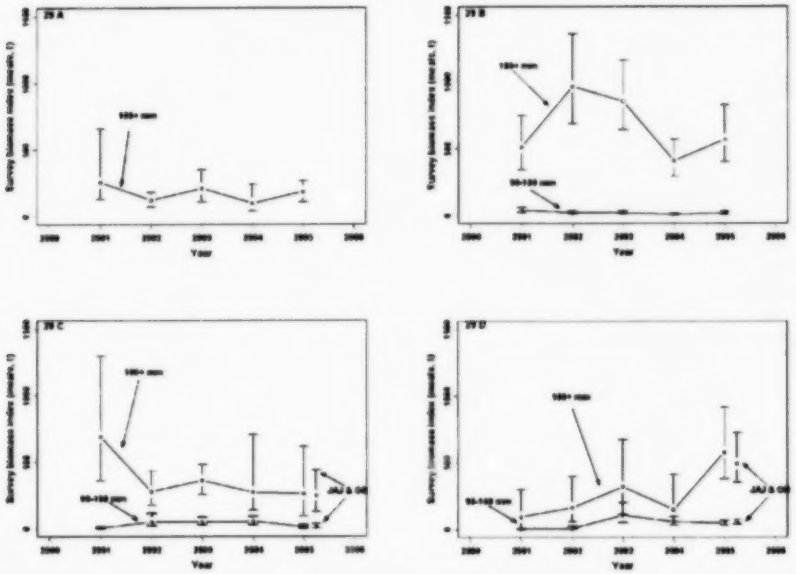


Figure 5. Survey biomass index (meats, t) with 95% confidence intervals for commercial size (100+ mm shell height) and recruit (90-99 mm shell height) scallops in SFA 29.

Lobster Bycatch

The stratified mean number of lobsters caught in the 2005 survey (1.63 per tow) was 66% higher than that of the 2004 survey (0.98 per tow). Similar to previous years, most lobsters were caught in subareas A and B (Figure 6). However, unlike previous years, a relatively large number of lobsters was also caught in Subarea C during 2005. Based on scallop survey data from 2001 to 2005, lobsters were caught predominantly in tows on till/silt and bedrock, with reduced numbers observed in tows on glacial till and thin sand. The SFA 29 survey was conducted in September during 2001-2003 and in October during 2004-2005; the impact of survey timing on lobster bycatch is unknown.

The regular monitoring by onboard observers of lobster bycatch from this fishery is unique relative to other scallop fisheries. Observer coverage was required for both fleets at a rate of one observed trip per vessel. The resulting coverage was that 9% of the trips were observed in 2005. Lobsters were observed in all subareas but the highest catch rates were in Subarea B (Figure 7). The total number of lobsters caught in the 2005 scallop fishery was estimated to be 4400. Regulations required that all lobsters caught be returned to the water. Of those caught, 5% were dead and 17% were injured. Assuming that observed trips are representative of the whole fishery, 1519 lobsters are estimated to have been returned to the water either dead or injured in 2005. This level of bycatch may be considered quite low given that lobster fishery landings in the areas corresponding to SFA 29 approximated 3634 mt (about 6.5 million lobsters) in 2005.

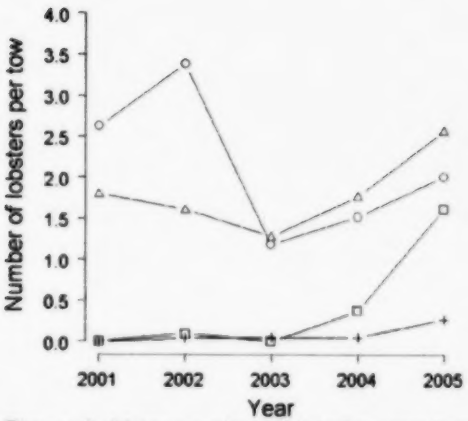


Figure 6. Mean number of lobsters per tow in the annual scallop survey of SFA 29. 29 A: open triangles; 29 B: open circles; 29 C: open squares; 29 D: crosses.

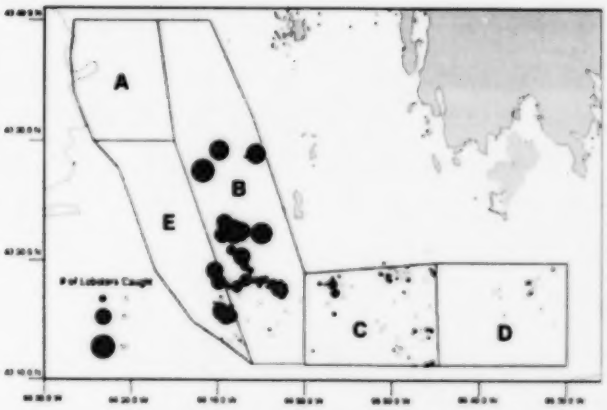


Figure 7. Location and number of lobsters caught in SFA 29 scallop fishery during 2005. Crosses indicate locations where no lobsters were captured.

Sources of Uncertainty

There are only five years of extensive surveys of subareas A to D in SFA 29. Within this five year time series, three vessels have been involved and there is limited comparative data available. Although the same type of gear and fishing practices were used on all three vessels, there may be differences in fishing power among them. However, the spatial distribution of scallops observed in 2005 appeared to be consistent between the two vessels employed and was also consistent with patterns noted in previous years. Pending further investigation, all five years of survey data will be used to interpret trends for this fishery.

During 2001–2005, the survey design for SFA 29 was modified from simple random sampling over the whole area, to random sampling within strata defined as subareas A–E, to random sampling within strata defined based upon surficial geology. While changes in survey design do not appear to have changed the interpretation of the overall trends in biomass of commercial size scallops and seem to have improved the precision of abundance estimates, the impact of these changes on the scientific advice requires further evaluation.

Little is known about the recruitment or total mortality dynamics in this area.

CONCLUSIONS AND ADVICE

The annual survey indicates that biomass levels of commercial size scallop have remained fairly constant in subareas A and C with little recruitment to commercial size expected for the next three years. Biomass has increased in subareas B and D in 2005 with recruitment to the commercial size class expected in Subarea D for 2006.

Evaluations of the impact of fishing were conducted using a population model for subareas B, C, and D (Table 2). Specifically, a range of potential catch levels were evaluated for each subarea in terms of: 1) the probability that they would result in the post-fishery biomass in 2006 being less than the post-fishery biomass in 2005; and 2) the percentage decrease in 2006 from 2005. For example, catches of 75 to 100 t, 25 to 50 t, and 50 to 75 t would result in less than a 50% chance of a decrease in the 2006 biomass relative to 2005 for subareas B, C, and D, respectively. Alternatively, setting catch levels such that the mean expected decrease was

equal to zero would result in 150–200 t for Subarea B, 75–100 t for Subarea C, and 125–150 t for Subarea D.

The population model did not fit the data for Subarea A. Very few scallops with shell heights less than 100 mm were found by the survey in this subarea. While a catch of 80 t in 2004 and 4 t in 2005 did not seem to result in a large decline in survey biomass, continued fishing in Subarea A in 2006 will probably be limited to scallops ages 6 and older due to limited recruitment.

There was not enough survey information to recommend catch levels for Subarea E. This subarea appears to offer marginal habitat for scallop.

Table 2. Predicted impact of different catch levels on population biomass in SFA 29 in 2006 based upon results of delay-difference model. Probability of decrease refers to probability of post-fishery population biomass (100+ mm shell height) in 2006 being less than in 2005.

Subarea	Catch in 2006 (t)	Probability of decrease	Mean decrease (%)
29B	50	0.48	-9.3
	100	0.51	-4.9
	125	0.53	-2.7
	150	0.56	-0.5
	200	0.61	3.9
	250	0.64	8.3
	300	0.67	12.7
29C	25	0.47	-12.5
	50	0.52	-7.6
	75	0.56	-2.6
	100	0.60	2.3
	125	0.64	7.2
	150	0.67	12.1
	200	0.73	22.0
29D	50	0.48	-12.3
	75	0.50	-9.0
	100	0.54	-5.8
	125	0.56	-2.5
	150	0.59	7.2
	200	0.64	7.9

OTHER CONSIDERATIONS

Bycatch of lobster in SFA 29 was low in 2005. Based upon comparisons of lobster landings among SFA 29, areas adjacent to SFA 29, and LFA 34 (as a whole), there does not appear to be any immediate impact of the scallop fishery on lobster landings. However, the impact of the scallop fishery on juvenile lobsters and lobster habitat were not evaluated and if there is any impact, it may not be apparent in the lobster fishery for a number of years.

During the molting period, lobsters are less mobile, more prone to injury, and involved in mating. Measures have been taken to avoid scallop fishing in areas where, or at times when, lobsters are in high concentrations or are soft-shelled. The closure of a portion of Subarea B in previous years due to high lobster bycatch has been an example of the type of measure that could be employed.

Continued mandatory observer coverage of lobster bycatch with details on the condition of lobsters caught should be continued in 2006.

SOURCES OF INFORMATION

Smith, S.J., M.J. Lundy, and C. Frail. 2005. Scallop Fishing Area 29: Stock Status and Update for 2005. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/040.

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ISSN 1480-4913 (Printed)
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CORRECT CITATION FOR THIS PUBLICATION

DFO, 2006. Assessment of Scallops (*Placopecten magellanicus*) in Scallop Fishing Area (SFA) 29 West of Longitude 65°30'W. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2006/028.

APPENDIX

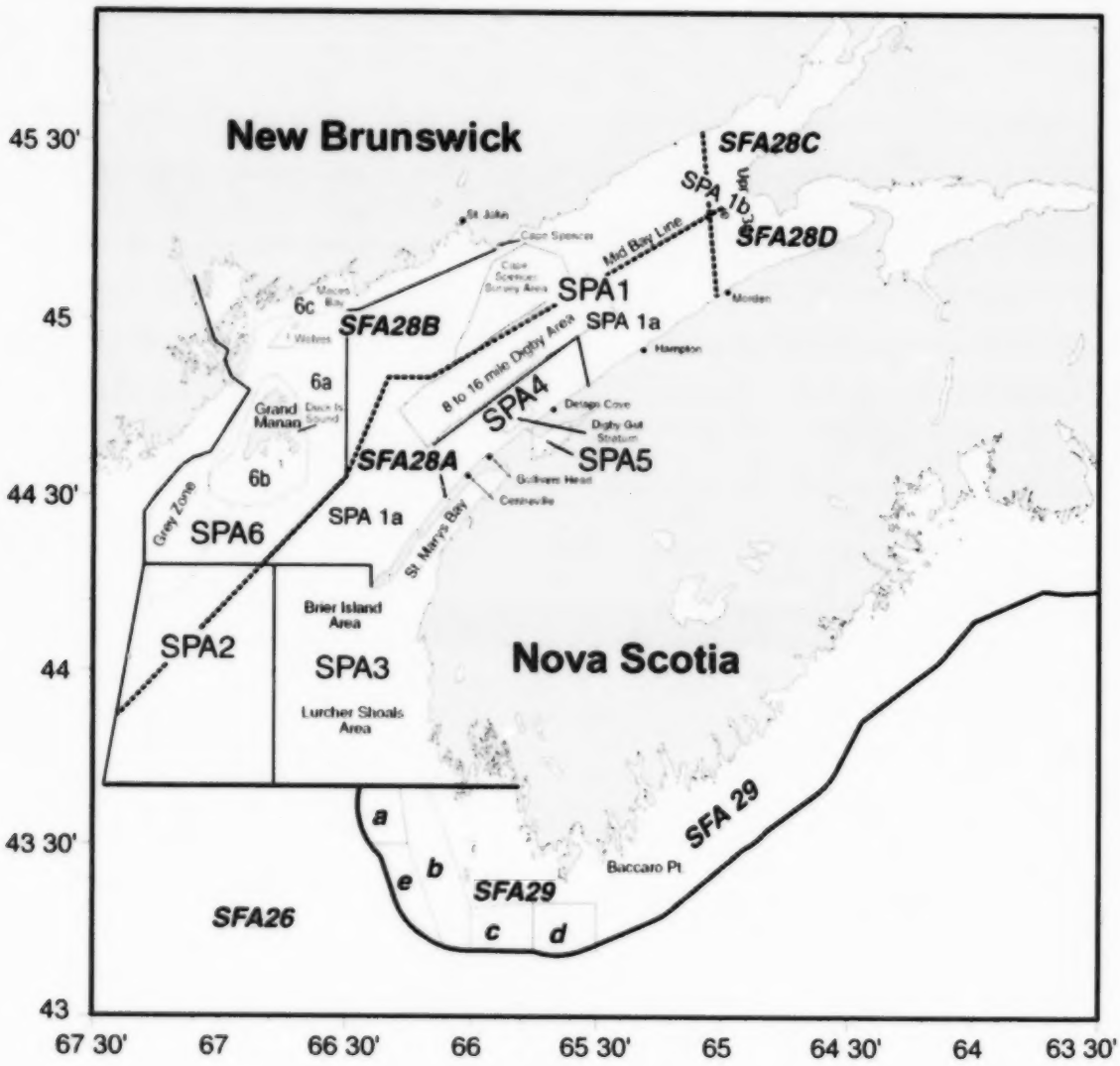

Figure 8. Locations and place names used in this Science Advisory Report.